

REMARKS

Claim 1 has been amended to include the limitations of claim 3 and claim 9. Support for the amendment can be found throughout the specification, in particular in originally filed claims 3 and 9. Claims 3 and 9 have been cancelled without prejudice or disclaimer to the subject matter. Claims 4, 6, 8 and 10 are amended to correct dependencies in light of the amendment to claim 1. No new matter has been added. Claims 1, 2, 4-8 and 10-12 are currently pending in the present application.

Rejections Under 35 U.S.C. §103(a)

Akahori *et al.*

Claims 1-8 and 11-12 are rejected under 35 U.S.C. §103(a) for obviousness over Akahori *et al.* (U.S. Patent No. 6,783,434, hereinafter "Akahori"). The Examiner alleges that the Akahori patent teaches a chemical-mechanical polishing slurry for shallow trench isolation that includes all of the limitations of claim 1 except deionized water. The Examiner asserts that it would have been obvious to one skilled in the art at the time the invention was made to modify the CMP slurry of the Akahori patent to include each and every component of the claimed invention, specifically the use of deionized water. See Office Action at pages 2-3.

Applicants respectfully traverse the rejection. The recently revised Examiner guidelines for assessing obviousness set forth detailed requirements based on asserted rationales for obviousness. The Rationales To Support Rejections Under 35 U.S.C. §103 provide the following possible rationales:

- (A) Combining prior art elements according to known methods to yield predictable results;
- (B) Simple substitution of one known element for another to obtain predictable results;
- (C) Use of known technique to improve similar devices (methods or products) in the same way;
- (D) Applying a known technique to a known device (method or product) ready for improvement to yield predictable results;

(E) "Obvious to try" – choosing from a finite number of identified, predictable solutions, with a reasonable expectation of success;

(F) Known work in one field of endeavor may prompt variations of it for use in either the same field or a different one based on design incentives or other market forces if the variations are predictable to one of ordinary skill in the art; and

(G) Some teaching, suggestion, or motivation in the prior art that would have led one of ordinary skill to modify the prior art reference or to combine prior art reference teachings to arrive at the claimed invention.

See MPEP 8th Edition, rev. 6, §2141.

Applicants proceed with the understanding that this rejection conforms to rationale G quoted above. The MPEP further sets forth the requirements for an obviousness rejection under this rationale:

To reject a claim based on [rationale G], Office personnel must resolve the Graham factual inquiries. Then, Office personnel must articulate the following:

(1) a finding that there was some teaching, suggestion, or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings;

(2) a finding that there was reasonable expectation of success; and

(3) whatever additional findings based on the Graham factual inquiries may be necessary, in view of the facts of the case under consideration, to explain a conclusion of obviousness.

The rationale to support a conclusion that the claim would have been obvious is that "a person of ordinary skill in the art would have been motivated to combine the prior art to achieve the claimed invention and that there would have been a reasonable expectation of success." *DyStar Textilfarben GmbH & Co. Deutschland KG v. C.H. Patrick Co.*, 464 F.3d 1356, 1360, 80 USPQ2d 1641, 1645 (Fed. Cir. 2006). **If any of these findings cannot be made, then this rationale cannot be used to support a conclusion that the claim would have been obvious to one of ordinary skill in the art.**

See MPEP 8th Edition, rev 6, §2143

The invention, as recited in currently amended claim 1, is directed to a polishing slurry for shallow trench isolation. The slurry comprises two components: The first component comprises an aqueous abrasive solution, which is a mixture of deionized water, polishing particles and a polishing particle dispersant. The second component comprises an aqueous additive solution comprising deionized water, 0.001 to 5 weight % of a poly(meth)acrylic acid polymer, 0.001 to 4 weight % of a nitrogen-containing organic cyclic compound and 0.001 to 3% by weight of an amine-group compound. Claim 1 has been amended to recite the features of the additive solution formally recited in cancelled claims 3 and 9, specifically the presence and identity of the nitrogen-containing organic cyclic compounds. The present invention further comprises, as additives, poly(meth)acrylic acid polymer, nitrogen-containing organic cyclic compound and amine-group compound so that the abrasion selectivity as well as abrasion rate of silicon oxide layer can be enhanced as compared to that of silicon nitride layer.

Akahori is directed to a CMP abrasive comprising a cerium oxide slurry containing: cerium oxide particles; a dispersant and water; a liquid additive containing a dispersant and water; and a liquid additive for the CMP abrasive. The slurry of Akahori comprises polyamine acrylate or polyammonium acrylate containing up to 10 mol % of free ammonia or free amine as a polymer dispersant. Akahori neither teaches nor discloses the aqueous additive recited in presently amended claim 1. The Examiner states that Akahori teaches the aqueous additive solution of the claimed invention comprising Applicants claimed range of 0.001 to 4 weight % of a nitrogen-containing organic cyclic compound. Applicants respectfully submit that nowhere in Akahori are organic cyclic nitrogen-containing compounds mentioned.

Applicants describe the advantages of the nitrogen-containing organic cyclic compounds at paragraph [0019] of the specification:

“Nitrogen-containing organic cyclic compounds assume the role of reducing the speed of polishing of a nitride film and increasing selectivity by improving their adsorption between an acrylic acid compound and nitride film.”

The present invention employs nitrogen-containing organic cyclic compound (which is basic) rather than poly(meth)acrylic acid polymer (which is acidic) alone. Therefore, the nitrogen-containing organic cyclic compound enhances adsorption between the poly(meth)acrylic acid

polymer and the nitride layer to decrease the abrasion rate of the nitride layer and increase the selectivity ratio. Examples 1 and 2 illustrate that the abrasion selectivity ratio is noticeably enhanced by using nitrogen-containing organic cyclic compound (which is basic) (46:1), rather than using poly(meth)acrylic acid polymer (which is acidic) alone (25:1).

Akahori contains no description or disclosure regarding nitrogen-containing organic cyclic compounds which serve to decrease abrasion rates of the nitride layer. In contrast, Akahori simply describes polyamine acrylate or polyammonium acrylate comprising up to 10 mol % of free ammonia or free amine without any description or disclosure related to nitrogen-containing organic cyclic compounds. The free ammonia or free amine are present as extricated from polyamine acrylate or polyammonium acrylate, but are different from nitrogen-containing organic cyclic compounds according to the present invention.

The Comparative Example of the present invention describes a composition with enhanced dispersibility of ceria formed by using a polyacrylic acid ammonium salt type dispersant, which comprises a dispersant in the same category as the polymeric dispersant used in Akahori. The use of this compound resulted in abrasion rate of the silicon nitride layer as high as 500 Å/min while exhibiting a very low abrasion selectivity ratio (4.4:1) of silicon oxide layer to silicon nitride layer. Akahori does not demonstrate the enhanced abrasion selectivity ratio of the silicon oxide layer which is achieved by lowering the abrasion rate of the nitride layer through addition of a nitrogen-containing organic cyclic compound.

Thus, the prior art does not teach, suggest or motivate one of skill in the art to modify the teachings of Akahori. The Office Action does not provide such reason, suggestion, or motivation indicating how or why a person skilled in the art would have been motivated to alter the abrasive solution of Akahori to form the polishing slurry comprising a poly(meth)acrylic acid polymer, a nitrogen-containing organic cyclic compound and an amine group compound to enhance abrasion selectivity ratio and abrasion ratio, as recited in Applicants' amended claim 1. This is because Akahori fails to appreciate the improved speed and selectivity provided by the addition of the nitrogen-containing organic cyclic compound and amine group compound. A reasonable expectation of success in the production of a polishing slurry for shallow trench isolation with the improved speed and selectivity of Applicants' invention is not present. Hence, claims 1, 2, 4-8 and 10-12 are non-obvious over Akahori. Withdrawal of the rejection is respectfully requested.

Akahori *et al.* in view of Motonari *et al.*

Claim 9 is rejected under 35 U.S.C. §103(a) for obviousness over Akahori in view of Motonari *et al.* (U.S. Patent No. 6,447,695, hereinafter "Motonari"). The Examiner states that although Akahori fails to teach the specifically claimed nitrogen-containing organic cyclic compounds of the present invention, Motonari teaches that it is known to use a component for adjusting the polishing rate containing a derivative of a heterocyclic compound with an amino group (such as components of diazine and triazine). The Examiner then concludes that it would have been obvious to one of ordinary skill in the art to modify the invention of Akahori to include Applicants' specifically claimed nitrogen-containing organic cyclic compounds because Motonari teaches that such compounds are known to be effective as polishing rate adjusters. See Office Action at page 6.

Applicants respectfully traverse the rejection. Although claim 9 has been cancelled, thus making this rejection moot, Applicants address this rejection in order to provide a more complete response. As described in detail above, the nitrogen-containing organic cyclic compounds recited in claim 1 are not taught by Akahori. Contrary to the Examiner's assertions, Motonari does not cure this deficiency.

The present invention relates to an abrasive composition for abrading a silicon oxide layer. Motonari describes an abrasive composition for copper. The nitrogen-containing organic cyclic compound according to Motonari is used to lower the abrasion rate of a copper layer and to enhance the abrasion rate of the tantalum-type layer. This is a completely different function from that taught by present invention. The prior art does not teach, suggest or motivate one of skill in the art to modify the teachings of Akahori. One of skill in the art would have no motivation to modify the abrasive solution of Akahori with that described in Motonari to form the polishing slurry comprising a poly(meth)acrylic acid polymer, a nitrogen-containing organic cyclic compound and an amine group compound to enhance abrasion selectivity ratio and abrasion ratio as recited in Applicants' claim 1. This is because the two compositions act upon two different subject layers. A skilled artisan would have no expectation that the abrasive copper compositions disclosed in Motonari would successfully function as polishing rate adjusters for abrading a silicon oxide layer. Withdrawal of the rejection is respectfully requested.

Akahori *et al.* in view of Tsai (U.S. Patent No. 6,174,454.

Claim 10 is rejected under 35 U.S.C. §103(a) for obviousness over Akahori in view of Tsai (U.S. Patent No. 6,174,454, hereinafter "Tsai"). The Examiner characterizes Akahori as above. The Examiner states that while Akahori fails to teach the specifically claimed amine-group compounds, Tsai teaches improved polishing selectivity through the addition of various amounts of tetra-alkyl in ammonium hydroxide to produce a CMP polishing slurry. The Examiner then concludes that it would have been obvious to modify the slurry of Akahori to include the claimed amine-group compounds because Tsai teaches that the components improve the slurry. See Office Action at page 6.

Applicants respectfully traverse the rejection. The present invention relates to an abrasive composition for abrading a silicon oxide layer. Tsai teaches an organic SOG CMP composition. The amine-group compounds described in Tsai are weak bases contained in a buffer solution and used as a pH adjusting agent. Tsai does not remedy the deficiencies of Akahori in teaching the nitrogen-containing organic cyclic compounds of currently amended claim 1. There is no motivation for one of skilled in the art to modify the teachings of Akahori with the disclosure of Tsai to form the polishing slurry comprising a poly(meth)acrylic acid polymer, a nitrogen-containing organic cyclic compound and an amine group compound to enhance abrasion selectivity ratio and abrasion ratio, as recited in Applicants' claim 1. The combination of the two references does not result in Applicants' current invention. Withdrawal of the rejection is respectfully requested.

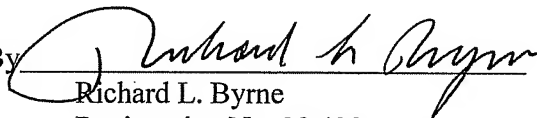
Application No. 10/594,537
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CONCLUSION

Based on the foregoing amendments and remarks, reconsideration of the rejections and allowance of pending claims 1, 2, 4-8 and 10-12 are respectfully requested.

Respectfully submitted,
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